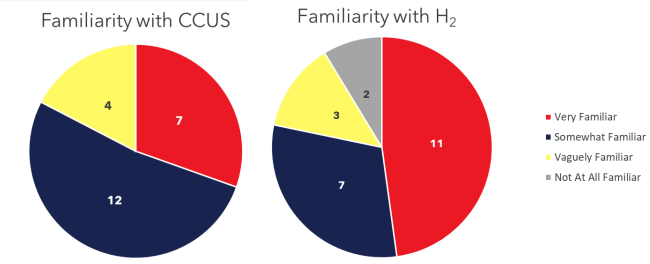
# Pennsylvania $H_2$ & CCUS Market Readiness Report

The Team Pennsylvania Foundation fielded a 38-question survey and conducted follow-up interviews targeting large energy consumers to understand the current status of and future opportunities for hydrogen ($H_2$) and carbon capture, utilization, and sequestration (CCUS) demand in Pennsylvania.

While the Infrastructure Investment and Jobs Act of 2021 and the Inflation Reduction Act of 2022 appear to have precipitated a wave of public and private interest and investment in studying and planning CCUS and low-carbon $H_2$ infrastructure, deployment has been accelerated mainly in large energy and manufacturing firms and has favored $H_2$ over CCUS.

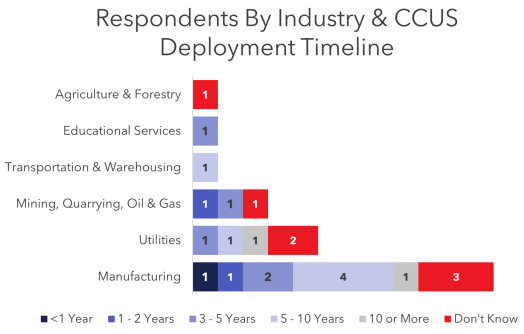
Team PA collected 23 complete survey responses from a relatively diverse set of organizations, with manufacturers representing 50% (12) of respondents. Other respondents included companies in oil, gas, mineral processing, utilities, agriculture and educational institutions. Surveyed organizations were relatively large, with 70% (16) employing 100 or more workers in their Pennsylvania operations, and 22% (5) employing 1000 or more. Respondents' operations were concentrated in Southwest and Southeast Pennsylvania, and the Central, Northeast, and Lehigh Valley regions were also well-represented.

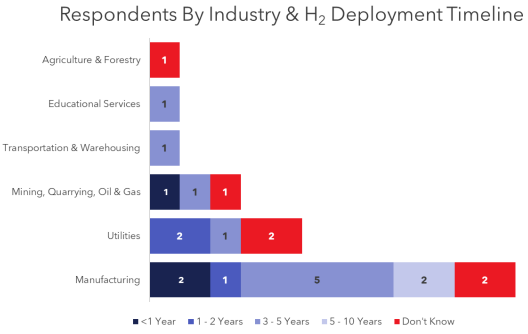
**Finding 1: Pennsylvania organizations are familiar with both CCUS and $H_2$ technologies, but $H_2$ deployment plans are more mature.**




18 surveyed organizations self-identified as "Somewhat" or "Very" familiar with $H_2$ applications, compared with 19 organizations "Somewhat" or "Very" familiar with CCUS. Of these, nearly all were industrial manufacturers in metals, chemicals, consumer products manufacturing, or energy companies, together representing between 10,000 and 15,000+ Pennsylvania employees.

This familiarity – and lack thereof – was reflected in the confidence with which interviewees spoke about the likelihood of CCUS infrastructure deployment and the hypothetical timelines respondents' associated with it. 15 organizations affirmed their ability to begin accepting $H_2$ within 5 years assuming it was competitive to do so – only 9 organizations expressed confidence they could meet that same timeline with CCUS.



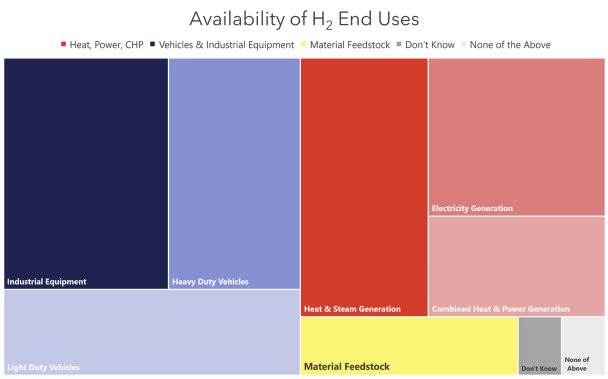



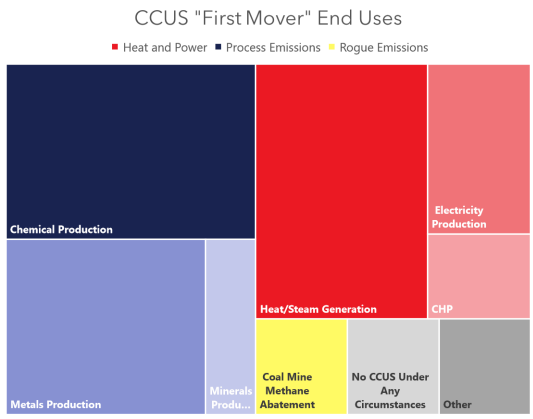

**Finding 2: Respondents recognize the adaptability of $H_2$, and most foresee multiple use cases for $H_2$ in their operations.**

When asked to identify which hydrogen end-uses were possible for their organization's operations, the average respondent selected 3 distinct $H_2$ applications in their business – indicating that industry does, in fact, consider cost-competitive $H_2$ a flexible fuel and a suitable alternative to traditional fossil fuels. While

the respondents most optimistic about $H_2$ deployment identified electricity production, steam and heat generation, and cogeneration as the most compelling near-term applications, nearly ⅔ of respondents overall indicated that $H_2$-powered vehicles and industrial equipment would have a place at their facilities.

**Finding 3: Power and heat generation in energy and manufacturing are the nearest-term applications for $H_2$ in PA – assuming a competitive price.**




65% (15) of organizations surveyed reported that they could deploy hydrogen in their operations within 5 years assuming a competitive price, largely in power production and heat generation. These applications require either specialized equipment or expensive retrofits; however, follow-up interviews with respondents confirmed that many had specifically sought equipment that could flexibly accept $H_2$ when designing and building new heat and power assets, while firms with older energy infrastructure indicated their willingness to use $H_2$-blended natural gas to achieve ESG commitments.

**Finding 4: Potential $H_2$ off-takers are most interested in policies that reduce the unit cost of hydrogen use and adoption.**

Though near-term applications for hydrogen require expensive infrastructure, respondents were aligned that achieving market liftoff could be best accelerated via direct subsidies of H2 production, including production tax credits and grant programs to fund production infrastructure. Novel proposals to reduce the cost of capital via project insurance and purchasing mandates were altogether less popular.

**Finding 5: Unlike $H_2$, CCUS in Pennsylvania depends on more than cost alone.**

Even in cases applications and scenarios where survey respondents preferred CCUS to $H_2$ solutions, the cost and operation of CCUS equipment were not the primary considerations. Respondents suggested that they would need business partners to manage emissions capture, concentration, transportation, and utilization or storage, emphasizing the importance of network effects that would only emerge from a mature carbon management ecosystem, including transportation infrastructure, storage solutions, regulatory clarity on liability, and demonstrated examples of tax-credit sharing. Respondents thought favorably of policy interventions that promoted inter-organizational partnerships.

**Conclusions**

Among organizations well-versed in $H_2$ and CCUS technologies, planning for $H_2$ adoption appears far more advanced: projects are better defined, largely do not require substantial changes in infrastructure or business operations, and are nearer to deployment. More work is needed to spur similar advancements on CCUS. Respondents' relative familiarity with $H_2$ over CCUS applications, and perceived barriers to deployment, suggest that while CCUS may have a future decarbonizing emissions, it is unlikely to be favored over clean $H_2$ for low-carbon power, heat, and steam generation – unless and until a price on carbon or permanent changes to tax credits make CCUS an attractive long-term investment.